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Johan Erik LINDSTROM et al.	)	Group Art Unit: 2661
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Application No.: 09/734,015	)	Examiner: Unassigned
	)	
Filed: December 12, 2000	)	
	)	
For: TELECOMMUNICATION SYSTEM FOR CONTROL OF MULTIPLE SWITCHES IN A COMMON ADDRESS SPACE	)	

CLAIM FOR CONVENTION PRIORITY

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following prior foreign application in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed:

Swedish Patent Application No. 9904553-6

Filed: December 13, 1999

In support of this claim, enclosed is a certified copy of said prior foreign application. Said prior foreign application was referred to in the oath or declaration. Acknowledgment of receipt of the certified copy is requested.

Respectfully submitted,

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PRV

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This is to certify that the annexed is a true copy of the documents as originally filed with the Patent- and Registration Office in connection with the following patent application.

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För Patent- och registreringsverket
For the Patent- and Registration Office

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A telecommunication system for control of multiple switches in a common address space

This invention relates generally to telecommunication system with nodes in which there are switches. In particular the invention relates to a telecommunication system of this kind wherein there is one node that controls its own switches as well as switches in other nodes.

The invention is of particular interest when there is an existing telecommunication system that needs to be expanded by adding new switches to the existing system. The added switches may be of other kinds than those used in the existing telecommunication system.

To expand an existing telecommunication system in this manner is a formidable task, requiring redesign of all of the software running in the existing telecommunication system.

U.S. Patent Serial No.5,960,004 in the name of Ramstrom et.al. is example of a software architecture that requires redesign of all of the existing software in the existing telecommunication system in which the new software is used. The development costs for the new software are accordingly high. The new software call model uses logical switch views in order to set up and release connections through a telecommunication system. The use of switch views to set up or release a connection requires much processor capacity. Once the new software has been loaded into the system the software will allow for expansion of the telecommunication system with new switches in new nodes.

An object of the present invention is to allow the addition of new switches in new nodes to an existing telecommunication system without the need to redesign all of the existing software in the telecommunication system to which new switches in new nodes are added. By re-use of existing software the development costs are reduced. In particular the traffic control functions of the existing telecommunication system shall be re-used, that is shall remain unaffected by the addition of the new switches in the new nodes. However, the existing software for control of connections has to be redesigned. This object is achieved with the means indicated in the enclosed

independent claims. In particular a connection through the expanded telecommunication system is set up, released and manipulated stating the physical inlets of the switches and using a global address space constructed in accordance with the principles of the present invention. The connection layer sets up, releases, and manipulates connections through the switches and between the switches.This new way of controlling the connections requires less processor capacity in comparison with said U.S. patent to Ramstrom. In accordance with this invention the inlets of the switches are addressed which is in contrast to the Ramstrom approach wherein the connection is addressed. The Ramstrom patent has a great flexibility which is not required by the present invention. Therefore the solution of the present invention is not as capacity demanding as Ramstrom.

In order to fully understand the claims, the description and the merits of the invention some expressions must be clarified and some characteristics of the invention must be made clear.

Definitions

In switch technology it is not proper to say that a switch has an input side and an output side, since each side of a switch can receive as well as send away a call. Instead a switch is said to have a number of inlets. Each inlet has an input and an output. An inlet is a two-way entity. Between two inlets either a two-way or a one-way connection can be established. A two-way connection will be using the input and the output of an inlet, a one-way connection only one of these.

In a telecommunication system a node is a processor domain. A processor domain is the system portion that a processor is controlling.

Inventive features

The telecommunication system of the present invention comprises two or more nodes. One node (referred to as an internal node or an existing node or a controlling node) controls one or more switches (also referred to as one or more added switches) that are resident in one or more other nodes (processor domains). The other nodes are referred to as external nodes.

The existing node can control the entire or only a part of the added switch or switches in an external node. An external node may have other traffic that is controlled by its own traffic control system, said other traffic is thus not controlled by the control node.

The switches in the existing node may be of one type and in each external node the switches may be of different types. The telecommunication system may thus comprise mixed types of switches, such as STM switches, ATM switches, IP switches and other types of switches.

All external nodes have a common format for the manner in which the present or publish themselves to the controlling node. In particular this format is ID of the inlet group and ID of the particular inlet in the identified group. In some switch systems an inlet group is referred to as a switch device and the particular inlet of the identified switch device is reffered to as channel.

The existing node may comprise a group switch and a subscriber switch stage. This being the case the group switch is controlled by group switch multiple points (GS MUPS) and the subscriber switch stage is not controlled by global addresses but by control store positions.

A portion of the global address space is reserved for the local address space of the controlling node. The reserved portion starts at address 0 and ends at address X, X being a parameter the value of which depends on at least three motives that optionally may be used separately or in combination. One such motive is that the new software used for control of connections, this software being referred to as a connection handler, shall be back compatible with old users (such as old trunks) of the addresses in the local address space of the existing node. Such old users may not, depending on the particular case, be able to handle the large global address space proposed by the invention. The reserved portion is therefore made equal to the address space the old users are capable of handling. A second motive is to reduce processor capacity by using, in the reserved portion of the global address space, that same address values as those used in the local address space of the controlling node. In doing this there is no need to map from global addresses to local addresses,

thus reducing execution capacity. A third motive is the following: If a node is enhanced in accordance with the present invention so as to be a controlling node and this enhanced node is to control its own switch only, thus not any additional switches in any external nodes, then the portion reserved in the global address space is made equal to the local address space of the existing switch. This will save any mapping activities as well as reduce processor capacity.

It should be noted that in case there are no old users to consider, that is there is no need to provide back-compatibility, then X can be zero which means that no portion of the global address space is reserved.

The global address is a global multiple position which is translated into a physical multiple position for the existing switch, or which is translated into a virtual multiple position for the external switch or switches. A virtual multiple position represents the local address in the local address space of the external switch or switches. The global addresses and their respective translations are stored in a table together with the identity of the respective switches. The table is created when the local addresses of the switch or switches in the existing node and the local addresses of the switches of the external node or nodes are allocated to the global addresses. is performed and wherein the information stored in the table is used by the connection handler when a connection should be set up.

Description of the drawings

Fig. 1 Is an overall view of the telecommunication system in accordance with the invention,

Fig. 2 is an overall view of the invention showing a system A controlling its own STM switch as well as an extern ATM switch and an interconnection trunk, said entities together forming a telecommunication system in accordance with the present invention,

Fig. 3 is showing the hardware configuration of system A in Fig. 2 as seen from access point of view,

Fig. 4 is showing the hardware configuration of the system of Fig 2(?)

Fig. 5 is showing a layered structure of the telecommunication system in accordance with the invention,

Fig. 6 is showing how the connection handler controls the hardware interfaces

Fig. 7 is an overall view of the system of Fig. 2 wherein nine basic call cases have been illustrated,

Fig. 8 is a simplified view of the system shown in Fig 2 wherein the nine basic call cases of Fig 6 have been reduced to three, two of which are identical from connection layer point of view,

Fig. 9 illustrates the global address space, gMUP range, and how portions thereof (GSMUPs, vMUPs, GSMUPs, GSMUPs/vMUPs) are assigned to different switches (MG switch, GS switch, another external switch in the telecommunication system of the present invention and, to the left the internal switch in system A,

Fig. 10 is a illustrating a file having in its middle column the local address spaces of the switches of the present telecommunication system, in its left column the global addresses in the global address space in the left column and in its right column the switch identities, this file being shown by the shaded portion, and this file showing the allocation of local addresses to global addresses and the switch IDs,

Fig. 11 is a view showing a call example wherein a call is set up between users GMUP1 and vMUP1 residing in switches belonging to two different nodes, GS in the controlling node and ATM in the external controlled node, this Figure showing signalling between the indicated entities of the telecommunication system,

Fig. 12 is a similar view to Fig. 11 and illustrates the release of the call that was set up in Fig. 10,

Fig 13 is a view similar to Fig 11 and illustrates the connection case 3 shown in Fig 8, and

Fig. 14 is a view similar to Fig 13 and illustrates how the call set up in Fig. 12 is released.

Detailed description

In the following detailed description system A is the controlling node referred to in the claims, connection subsystem is the connection handler referred to in the claims and connection handling is the connection handler referred to in the claims. MG is the external node or other node referred to in the claims.

1 Background

This report is a description of the impacts in the connection services of a telecommunications system as it is further developed to control new switches and new switch technologies. A telecommunication system can be described as consisting of three layers

Call / Application layer

Connection handling layer and

Bearer service layer

In the bearer service layer, switches and other types of HW will be found as well as HW drivers for this equipment.

In the connection handling layer, there will be generic functions to relay requests for HW manipulation to the proper HW driver.

The Call / Application layer handles all the traffic control functions and decides what HW connections should be done based on information e.g received via the trunks.

This is a description of how a system consisting of all these three layers can be further developed in the Connection handling layer to control a multitude of switches, both in the own Bearer service layer as well as in other nodes/ machines, i.e. external switches, without affecting existing call control.

The existing three layer system will be referred to as SystemA in this report, and any external system, with HW controlled by systemA will be referred to as MG.

Today there is an STM based SystemA, with a wide variety of applications and a STM based connection services. There is also an ATM based system that supports only limited set of services, the MG. The idea in system design is to use both systems as one Combined Telepcommunication system, using the switching capabilities of both switches, as well as call services supported by SystemA. The systems will not be integrated, it will rather be built as a "loosely coupled node", so to make possible various independencies (separate projects, separate O&M, independent development of systems). From a traffical point of view, the system can be perceived as one transit node. By reusing STM HW in SystemA, there will also be need for a speech carrying bearer between the SystemA and MG, the Interconnect Trunk, IT.

Scope of this report is to define the evolution of the connection control in the SystemA so it can control connection both in the SystemA and in the MG. This will consist of e.g. setting up and releasing paths within the different switches, as well as controlling the interconnect trunk between the systems.

Figure 1a, shows the existing Telecommunication system and figure 1b, shows how the Telecommunication system will be implemented as new external switch is controlled from the original system.

In figure 2, it is shown how SystemA is controlling a its own STM switch as well as an external ATM switch and an interconnect trunk.

The new ideas described later in this report is not limited to extending a system from STM to STM/ATM. The technique can be used for introduction of new switches for any bearer types, based on a call control adapted to any other bearer services. We use STM and ATM purely as an example.

2 Present System

2.1 HW Configuration

In figure 3, the basic HW modules in SystemA before the new switch technology is shown.

2.2 Traffic control

If systemA is designed to handle STM based traffic, Traffic control, TC, in the Call/Application layer will order connection handler to operate on the switch(es) in the system.

Connection handling layer will send switching orders to the Group Switch, GS, e.g. to create paths so speech can be carried between two different positions in the switch. If the call is going through several switches, TC will send individual orders for all these switches. Connection handler will then address and control all these switches.

The connection layer may be more or less visible in the system.

2.3 Group Switch Traffical Interface

Switch control for GS and ATM switch is performed by Connection Subsystem, COS in SystemA. When an application wish to manipulate switch resources, it should use only the specified user interface implemented by COS.

The Group Switch provides a number of services to select, operate and release narrow-band paths in the Group Switch. The paths can be oneway, bothway or asymmetrical bothway connections. Asymmetrical is a oneway connection that can be changed into a bothway without seizure of new resources.

Examples of some typical basic traffical operations available towards a Group Switch.

* Select bothway path (secures HW resources)

* Operate bothway path (through connection)

* Select and Operate bothway path

* Release bothway path

* Convert path to asymmetrical

* Convert path to bothway

* Select oneway path

* Operate oneway path

* Select and Operate oneway path

* Release oneway path

A path is a connection between two MUPs. A MUP can only receive speech from one other MUP. A MUP can send speech to several other MUPs.

3 Target System

3.1 HW Configuration

Figure 4, shows the Combined system from HW and access point of view. Only relevant HW is shown.

3.1.1 SystemA

SystemA access (ET) is of STM type (it could be either PCM or 155 Mbit/s SDH). All ETs can send all standard tones used when trunks signal in transit applications to subscribers (BUSY, CONGESTION etc.). Voice and data connection between MG and SystemA, the Interconnect Trunk, should be done using 155Mbit/s SDH.

The SystemA switch is a circuit switched 64 kbit/s switch, referred to as the Group Switch (GS). The GS can operate oneway or both way connections between two MUltiple Points, MUPs. The GS is also capable to tap off (monitor) a setup connection to a third MUP. There can be several monitoring connections from one MUP. Each speech channel in an ET is connected to a MUP.

Any other special speech handling hardware like Message Sender, DTMF Receiver, Tone sender, conference equipment etc. is connected as pooled devices to the GS. These types of equipment is only available in the SystemA.

The SystemA has ethernet hardware to carry the control link which will carry the orders sent from SystemA to MG.

3.1.2 MG

The access in MG are ATM and STM. The STM is implemented as circuit emulation in the ET(CE). Voice and data connection between MG and SystemA, the Interconnect Trunk, should be done using ET(CE).

The switch in the MG is an ATM switch. This switch only support oneway or bothway connections. No monitoring can be performed. Supported ATM coding is AAL1 only. The CE ET will pack and unpack one 64 kbit/s channel into one AAL1 channel.

Control link will be based on TCP/IP/ethernet. The Central Processor in MG has the necessary HW and protocol stacks.

3.2 Implementation Concept

Connection subsystem and ETs in SystemA will see the MG as its extension, while existing parts of MG will not be very much aware of SystemA presence

In figure 5, the system structure of the Combined Switch is shown.

ATM switch, as perceived from telephony applications in SystemA, will look like an extension of GS. Connection operations performed on the ATM switch have to be similar to those performed on GS to not make the connection subsystem to complicated. MG access equipment (ETs and CEs) has to be seen as ordinary SystemA ETs for telephony applications in SystemA.

The general implementation idea is shown in SES is a subsystem in MG. A Logical switch - Switch Emulator (SE) is a part of SES, having interfaces towards SystemA and towards the ATM switch. It will communicate with SystemA in "STM language" and with ATM switch in "ATM language". The real ETs and CEs residing in MG will have their controlling functions Exchange Terminal Controllers, ETC, within the SES (MG). There will be another virtual counterpart of MG ET, residing in SystemA, the virtual ET, vET. The SE will use channels within switch device, SD; as the switching points (compare to MUP).

The trunks in SystemA will perceive the vET as a local SystemA ET, and not be aware of the absence of ET HW. The traffic control will use connection subsystem as usual to operate the switching equipment. Connection subsystem will use the logical switch in SES as its HW. In this way, SystemA telephony applications will have full control over the MG connections both Interconnect Trunk

The Interconnect Trunk, IT, will consist of a number of STM narrowband channels. The channels are terminated in ET on SystemA side and in CE on the MG side. It will occupy a range of MUPs on the SystemA (GS) side and also a range of channels grouped within SDs on the MG side.

There will be a fixed connection between Interconnect Trunk MUPs and Interconnect Trunk SE-channels. A device owner will be designed to associate the right SE-channel to the right MUP. The device owner will be referred to as the Interconnect Trunk, IT, It will be placed in SystemA.

3.3 Implemented Connection Subsystem

COS coordinates the orders given from the different users via the GS and other user interface and orders setting up of the Physical Path in the switching equipment.

3.3.1 General

The purpose of the Connection Subsystem, COS is to receive orders according to the user interface and change them into orders to the device drivers (3-pty devices, group switch, etc.).

Figure 6 shows how the connection handler controls the HW interfaces.

3.4 Basic Connection Cases

There are 9 basic call cases required for A to B calls. These are shown in figure 7.

From SystemA connection control's point of view, these basic traffic cases can be simplified. There are two assumptions:

Regarding SystemA connection control, there is no difference between ATM and STM access to/from the MG.

The traffic case STM(SystemA) - STM(SystemA) will not be considered, as it is already implemented in the design base.

When taking the listed assumptions into consideration, the 9 basic traffic cases are decreased to 3 basic connection cases. See figure 8, where the connection cases are signed by numbers.

Furthermore connection cases 1 and 2 are equal from SystemA Connection Subsystem point of view. This is since the Connection Subsystem does not distinguish between incoming and outgoing side of a call.

4 Introduction to implementation

4.1 General about implementation

There are two main alternatives to implement the target system from the design base described in chapter 3. One is to adapt existing implementation so trunk blocks with accesses in MG using the switch view technique shown in US patent " approximately APPLICATION MODULARITY IN TELECOMMUNICATION SYSTEMS, Ramström et al, ca 1992".

The other is the method suggested here based on that the traffical users of the SystemA connection subsystem (call) will see no difference in controlling the GS or the MG or any other switch external or internal with any bearer service. The valid GS operations will be valid for the MG as well. The users will use the GS user interface to control the MG.

4.2 Implementation

Trunks will use MUPs as today. The MUP will represent a resource either in SystemA or in MG. The MUP will be used by traffic control as today.

4.2.1 Definition of gMUP and vMUP

Connection control in basic calls should be done without switch views. TC will set up the connections as today, which means that TC will operate path using MUPs.

MUPs used for addressing SystemA and MG resources have to be unique. It means that the range of MUPs belonging to MG must not overlay to those ranges that exist today within the SystemA.

The idea is to create a unique, global MUP (gMUP) range. Global MUPs will be seen by SystemA GS users (TC, ISUP/TUP, -Call layer). GMUPs will be translated into physical MUPs for GS, and virtual MUPs, vMUPs, for external switches, when directed towards the switch (GS or external switch).

A vMUP represents an inlet in an external switch and consist of SDid and channel.

GMUPs 0...X can be reserved for and associated with the corresponding physical MUPs (0...X). X could, for example, be set to 64k or to the maximum size of GS. X is an application parameter, i.e. a value set at production of a SW dump for a market.

The reasons are:

Old MUP owners and device owners might not be adapted to support >64k GS. X must be set to at least 64k, to avoid changes in the old users.

If X is set to the maximum size of GS, translation from gMUP to physical MUP is not necessary. It can be used for capacity reasons or to avoid changes in existing GS software, but also to avoid changes for devices which have already connected HW, when this function is added to an existing live SystemA.

Figure 9 shows the above concept. It also shows how the concept is open for unknown future switching systems to be controlled by the SystemA.

To make translation between gMUP and "local MUP / switch reference" possible, a gMUP file will be created. The pointer will correspond to a gMUP value. Each record will contain the local MUP (either physical MUP, or virtual MUP) and reference to where this local MUP belongs.

The SystemA users (trunks, TC) will see only gMUPs. When, for example, TC wants to operate the path, the MUPs sent by TC and received by Connection Subsystem will be translated into local MUPs with reference. Further, Connection Subsystem takes care to establish the paths through GS and/or external switch and possibly also over the Interconnect Trunk, IT. See figure 11.

In figure 10, the gMUP translation tabl is shown

The local MUP values, GS-MUPs or virtual MUPs, will be allocated to gMUPs when the O&M procedures are run to define new HW. O&M will ask

Connection Subsystem for gMUP interval. So, MG data is given to Connection Subsystem by administrative procedures.

The GMUP file size indirectly depends on the size of different switches.

The global MUPs can be seized one by one or in group. If they are seized in group, they are seized in consecutive order for consecutive virtual or global MUPs, i.e. in a range with no holes.

4.2.2 Call examples

4.2.2.1 Typical Call through SystemA and MG

After IAM/IFAM is received by ISUP/TUP, it will seize the Traffic Control, TC, with MUP1. As the TC analysis points to an outgoing route equipped with a virtual trunk, TC seizes the outgoing trunk and gets the vMUP1 from it. Order to select and operate path is sent to Connection Subsystem. Connection Subsystem seizes Interconnect Trunk and sends the order to Logical switch (SE) to establish MG part of the path. Then it selects and operates the SystemA part of the path.

This is shown in figure 11 where the path for connection case 1 is established.

Releasing from A side is shown in figure 12. When TC has received a release order, it orders release of the switch path towards the incoming side. At the same time TC releases the outgoing side. Connection Subsystem receives Release_bothway_path from incoming side and releases the switch path.

4.2.2.2 Typical Call through MG

After IAM/IFAM is received by route belonging to a virtual trunk, it seizes the TC with vMUP1. As the TC analysis points to an outgoing route belonging to outgoing virtual trunk, TC seizes it and gets the vMUP2 from it. Order to select and operate path is sent to Connection Subsystem. Connection Subsystem sends the order to Logical switch (SE) to establish the path.

This is shown in figure 13 where the path for connection case 3 is established.

Releasing from A side is shown in figure 14. When TC has received a release order, it orders release of the switch path towards incoming side. At the same time TC releases the outgoing side. Connection Subsystem receives Release_bothway_path from incoming side and releases the switch path.

5 Abbreviations and Definitions

ASV	Access Switch View
ATM	Asynchronous Transfer Mode
CE	Circuit Emulation
CH	Channel
CS	Combined Switch
COS	Connection Service Subsystem
DTMF	Dual Tone Multi-Frequency (Signalling)
DR	Digit Receiver
EC	Echo Canceller
ET	Exchange Terminal
ETC	ET Controller
gMUP	Global MUP
GS	Group Switch
GSH	GS Handler
HW	Hardware
IAM	Initial Address Message
IFAM	Initial and Final Address Message (TUP message)
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IT	Interconnect Trunk
MG	Media Gateway,
MS	Message Sender
MUP	Multiple Position
O&M	Operation and Maintenance
PCM	Pulse Code Modulation
SCP	Switch Control Protocol

SD	Switch Device
SDH	Synchronous Digital Hierarchy
SDId	Switch Device Identity
SE	Switch Emulator
SES	SystemA Logical switch Subsystem
STM	Synchronous Transfer Mode
SW	SoftWare
TS	Tone Sender, Time Switch
TUP	Telephony User Part
vET	Virtual Exchange Terminal
vMUP	Virtual MUP

CLAIMS

1 A telecommunication system comprising an existing node with at least an existing switch with physical inlets and a local address space for addressing said inlets, wherein at least one additional switch is added to the telecommunication system, at least one of said additional switches residing in a node external to the existing node, each of said additional switches having physical inlets and a local address space for addressing said inlets, and in the existing node creating

(a) a global address space comprising the local address spaces of all the switches

(b) and means for controlling all said switches using the global address space,

thus changing the existing node to a controlling node.

2. A telecommunication system in accordance with claim 1, wherein the controlling node controls the entire additional switch in an external node or a part of the additional switch.

3. A telecommunication system in accordance with claim 2, wherein the local address space of the additional switch in the external node comprises as many addresses as the number of inlets controlled by the controlling node.

4. A telecommunication system in accordance with claim 3, wherein an address in the global address space is mapped to an address in the local address space of a switch and the identity of the switch.

5. A telecommunication system in accordance with claim 4, wherein a connection handler in said controlling node performs said mapping.

6. A telecommunication system in accordance with claim 5, wherein the global addresses have the same format as the local addresses of the existing switch.

7. A telecommunication system in accordance with claim 6, wherein the format of the local addresses of said additional switches being the same as or different from the format of the global addresses.

8. A telecommunication system in accordance with claim 7, wherein the format of the local addresses of an additional switch in an external node expresses a group of inlets and the individual inlet in said group.

9. A telecommunication system in accordance with claim 8, wherein said format expresses switch device and switch device channel.

10. A telecommunication system in accordance with claim 9, wherein there are more than one external node each having at least one additional switch controlled by the controlling node, wherein said format is common to all external nodes.

11. A telecommunication system in accordance with claim 10, wherein the local addresses of said switches are allocated one by one to global addresses in a 1:1 relationship, or said local addresses of said switches are allocated in groups to groups of global addresses, the local as well as global addresses of a group being in consecutive order.

12. A telecommunication system in accordance with claim 11, wherein said allocation is made in the connection handler.

13. A telecommunication system in accordance with claim 12, wherein all said switches are addressed by their global addresses so as to appear as one single switch to a call handler in the controlling node.

14. A telecommunication system in accordance with claim 13, wherein said call handler is using two addresses in the global address space in order to set up, release, and manipulate a connection through the telecommunication system regardless of to which switch or switches the two global addresses are allocated.

15. A telecommunication system in accordance with claim 14, wherein said call handler is using the same interface to set up, release, and manipulate a connection through the telecommunication system as the call handler

previously used to set up, release, and manipulate connections in the existing switch.

16. A telecommunication system in accordance with claim 14, wherein inter-switch connections are independently set up by the connection handler in response to said call handler requesting a connection be set up between two global addresses in different switches.

17. A telecommunication system in accordance with claim 16, wherein the connection handler seizes an interconnection trunk, the interconnection trunk in response thereto returning two global addresses, one belonging to one of the switches and the other belonging to the other switch, the connection handler in response to reception of the two global addresses setting up a connection in each of the two switches.

18. A telecommunication system in accordance with claim 12, wherein a predefined part of said global address space is reserved for the existing switch and the local addresses of the existing switch are the same as the global addresses, thus not requiring any mapping in the reserved part.

19. A telecommunication system in accordance with claim 16, wherein said reserved part of the global address space starts at address 0.

20. A telecommunication system in accordance with claim 19, wherein the size of the reserved part is at least equal to the range of local addresses which software related to old trunks in the controlling node is capable of handling, thus providing backwards compatibility.

21. A telecommunication system in accordance with claim 20, wherein the size of the reserved part is at least equal to the maximum size of the existing switch, thus providing backwards compatibility for software related to the existing switch.

22. A telecommunication system in accordance with claim 20, wherein the size of the reserved part is at least equal to the maximum size of an enhanced existing switch with software capable of allocating global addresses, thus reducing execution time since no mapping is required.

23. A telecommunication system in accordance with claim 22, wherein said reserved part is less than the size of an enhanced existing switch, thus requiring allocation of global addresses for the local addresses above the reserved part.

24. A telecommunication system in accordance with claim 23, wherein when allocating a global address for a local address of the enhanced existing switch in the reserved part of the global address space the returned global address is the same as the local address, thus making the software doing the allocation independent of the size of the reserved part.

25. A telecommunication system in accordance with claim 1, wherein the size of the global address space is given by a control system in the controlling node.

26. A telecommunication system in accordance with claim 17, wherein the switches of the telecommunication system are of different kinds, thus providing a telecommunication system that comprises different kinds of switching technologies, where all switches are controlled by said controlling node.

27. A telecommunication system in accordance with claim 26, wherein the switches are selected from the group that consists of STM (synchronous transmission mode) based switches, ATM (asynchronous transmission mode) based switches or an IP (Internet Protocol) based switches.

28. A telecommunication system in accordance with claim 26, wherein the switch in the controlling node is an STM-based switch and the additional switch in the external node is an ATM based switch.

29. A telecommunication system in accordance with claim 28, wherein the switch in the controlling node is a group switch.

30. A telecommunication system in accordance with claim 29, wherein a global address is a global multiple position, which is translated into a group switch multiple position for the existing switch, or into a virtual multiple position for an additional switch in an external node, said virtual multiple position representing the local address of the additional switch.

31. A telecommunication system in accordance with claim 17, wherein the global addresses and their respective translations are stored in a table.

32. A telecommunication system in accordance with claim 31, wherein said table is created in the connection handler when said allocation is performed and the information stored in the table is used by the connection handler when a connection is set up.

33. A telecommunication system comprising an existing node with at least an existing switch with physical inlets and a local address space for addressing said inlets, said existing node having a layered structure comprising a bearer service layer with said existing switch and other hardware entities, a connection layer with generic functions for controlling the switch and the hardware entities and a call layer with traffic control functions and functions for deciding the connections to be made, wherein at least one additional switch is added to the telecommunication system, at least one of said additional switches residing in a node external to the existing node, each of said additional switches having physical inlets and a local address space for addressing said inlets, and in the existing node creating

(a) a global address space comprising the local address spaces of all the switches

(b) and means for controlling all said switches using the global address space,

which is used by the call layer.

34. A telecommunication system in accordance with claim33, wherein the controlling node controls the entire additional switch in an external node or a part of the additional switch.

35. A telecommunication system in accordance with claim 34, wherein the local address space of the additional switch in the external node comprises as many addresses as the number of inlets controlled by the controlling node.

36. A telecommunication system in accordance with claim 35, wherein an address in the global address space is mapped to an address in the local address space of a switch and the identity of the switch.

37. A telecommunication system in accordance with claim 36, wherein a connection handler in said controlling node performs said mapping.

38. A telecommunication system in accordance with claim 37, wherein the global addresses have the same format as the local addresses of the existing switch.

39. A telecommunication system in accordance with claim 38, wherein the format of the local addresses of said additional switches being the same as or different from the format of the global addresses.

40. A telecommunication system in accordance with claim 39, wherein the format of the local addresses of an additional switch in an external node expresses a group of inlets and the individual inlet in said group.

41. A telecommunication system in accordance with claim 40, wherein said format expresses switch device and switch device channel.

42. A telecommunication system in accordance with claim 41, wherein there are more than one external node each having at least one additional switch controlled by the controlling node, wherein said format is common to all external nodes.

43. A telecommunication system in accordance with claim 42, wherein the local addresses of said switches are allocated one by one to global addresses in a 1:1 relationship, or said local addresses of said switches are allocated in groups to groups of global addresses, the local as well as global addresses of a group being in consecutive order.

44. A telecommunication system in accordance with claim 43, wherein said allocation is made in the connection handler.

45. A telecommunication system in accordance with claim 44, wherein all said switches are addressed by their global addresses so as to appear as one single switch to a call handler in the controlling node.

46. A telecommunication system in accordance with claim 45, wherein said call handler is using two addresses in the global address space in order to set up, release, and manipulate a connection through the telecommunication system regardless of to which switch or switches the two global addresses are allocated.

47. A telecommunication system in accordance with claim 46, wherein said call handler is using the same interface to set up, release, and manipulate a connection through the telecommunication system as the call handler previously used to set up, release, and manipulate connections in the existing switch.

48. A telecommunication system in accordance with claim 46, wherein inter-switch connections are independently set up by the connection handler in response to said call handler requesting a connection be set up between two global addresses in different switches.

49. A telecommunication system in accordance with claim 48, wherein the connection handler seizes an interconnection trunk, the interconnection trunk in response thereto returning two global addresses, one belonging to one of the switches and the other belonging to the other switch, the connection handler in response to reception of the two global addresses setting up a connection in each of the two switches.

50. A telecommunication system in accordance with claim 44, wherein a predefined part of said global address space is reserved for the existing switch and the local addresses of the existing switch are the same as the global addresses, thus not requiring any mapping in the reserved part.

51. A telecommunication system in accordance with claim 50, wherein said reserved part of the global address space starts at address 0.

52. A telecommunication system in accordance with claim 51, wherein the size of the reserved part is at least equal to the range of local addresses which software related to old trunks in the controlling node is capable of handling, thus providing backwards compatibility.

53. A telecommunication system in accordance with claim 52, wherein the size of the reserved part is at least equal to the maximum size of the existing switch, thus providing backwards compatibility for software related to the existing switch.

54. A telecommunication system in accordance with claim 53, wherein the size of the reserved part is at least equal to the maximum size of an enhanced existing switch with software capable of allocating global addresses, thus reducing execution time since no mapping is required.

55. A telecommunication system in accordance with claim 54, wherein said reserved part is less than the size of an enhanced existing switch, thus requiring allocation of global addresses for the local addresses above the reserved part.

56. A telecommunication system in accordance with claim 55, wherein when allocating a global address for a local address of the enhanced existing switch in the reserved part of the global address space the returned global address is the same as the local address, thus making the software doing the allocation independent of the size of the reserved part.

57. A telecommunication system in accordance with claim 33, wherein the size of the global address space is given by a control system in the controlling node.

58. A telecommunication system in accordance with claim 49, wherein the switches of the telecommunication system are of different kinds, thus providing a telecommunication system that comprises different kinds of switching technologies, where all switches are controlled by said controlling node.

59. A telecommunication system in accordance with claim 58, wherein the switches are selected from the group that consists of STM (synchronous transmission mode) based switches, ATM (asynchronous transmission mode) based switches or IP (Internet Protocol) based switches.

60. A telecommunication system in accordance with claim 59, wherein the switch in the controlling node is an STM-based switch and the additional switch in the external node is an ATM based switch.

61. A telecommunication system in accordance with claim 44, wherein the switch in the controlling node is a group switch.

62. A telecommunication system in accordance with claim 61, wherein a global address is a global multiple position, which is translated into a group switch multiple position for the existing switch, or into a virtual multiple position for an additional switch in an external node, said virtual multiple position representing the local address of the additional switch.

63. A telecommunication system in accordance with claim 49, wherein the global addresses and their respective translations are stored in a table.

64. A telecommunication system in accordance with claim 63, wherein said table is created in the connection handler when said allocation is performed and the information stored in the table is used by the connection handler when a connection is set up.

65. A telecommunication system comprising a controlling node with at least one switch and at least one other node with at least one other switch controlled by the controlling node, each of the switches having physical inlets and a local address space addressing said inlets, and in the controlling node (a) a global address space comprising all local address spaces and (b) means for controlling all switches using the global address space.

66. A telecommunication system in accordance with claim 65, wherein the controlling node controls the entire other switch in an external node or a part of the switch in the other node.

67. A telecommunication system in accordance with claim 66, wherein the local address space of the switch in the other node comprises as many addresses as the number of inlets controlled by the controlling node.

68. A telecommunication system in accordance with claim 67, wherein an address in the global address space is mapped to an address in the local address space of a switch and the identity of the switch.

69. A telecommunication system in accordance with claim 68, wherein a connection handler in said controlling node performs said mapping.

70. A telecommunication system in accordance with claim 69, wherein the format of the local addresses of said other switches being the same as or different from the format of the global addresses.

71. A telecommunication system in accordance with claim 70, wherein the format of the local addresses of an other switch in an other node expresses a group of inlets and the individual inlet in said group.

72. A telecommunication system in accordance with claim 71, wherein said format expresses switch device and switch device channel.

73. A telecommunication system in accordance with claim 72, wherein there are more than one external node each having at least one other switch controlled by the controlling node, wherein said format is common to all external nodes.

74. A telecommunication system in accordance with claim 73, wherein the local addresses of said switches are allocated one by one to global addresses in a 1:1 relationship, or said local addresses of said switches are allocated in groups to groups of global addresses, the local as well as global addresses of a group being in consecutive order.

75. A telecommunication system in accordance with claim 74, wherein said allocation is made in the connection handler.

76. A telecommunication system in accordance with claim 75, wherein all said switches are addressed by their global addresses so as to appear as one single switch to a call handler in the controlling node.

77. A telecommunication system in accordance with claim 76, wherein said call handler is using two addresses in the global address space in order to set up, release, and manipulate a connection through the telecommunication system regardless of to which switch or switches the two global addresses are allocated.

78. A telecommunication system in accordance with claim 77, wherein said call handler is using the same interface to set up, release, and manipulate a connection through the telecommunication system as the call handler previously used to set up, release, and manipulate connections in the existing switch.

79. A telecommunication system in accordance with claim 77, wherein inter-switch connections are independently set up by the connection handler in response to said call handler requesting a connection be set up between two global addresses in different switches.

80. A telecommunication system in accordance with claim 78, wherein the connection handler seizes an interconnection trunk, the interconnection trunk in response thereto returning two global addresses, one belonging to one of the switches and the other belonging to the other switch, the connection handler in response to reception of the two global addresses setting up a connection in each of the two switches.

81. A telecommunication system in accordance with claim 75, wherein a predefined part of said global address space is reserved for the existing switch and the local addresses of the existing switch are the same as the global addresses, thus not requiring any mapping in the reserved part.

82. A telecommunication system in accordance with claim 81, wherein said reserved part of the global address space starts at address 0.

83. A telecommunication system in accordance with claim 82, wherein the size of the reserved part is at least equal to the maximum size of an enhanced existing switch with software capable of allocating global addresses, thus reducing execution time since no mapping is required.

84. A telecommunication system in accordance with claim 83, wherein said reserved part is less than the size of an enhanced existing switch, thus requiring allocation of global addresses for the local addresses above the reserved part.

85. A telecommunication system in accordance with claim 84, wherein when allocating a global address for a local address of the enhanced existing

switch in the reserved part of the global address space the returned global address is the same as the local address, thus making the software doing the allocation independent of the size of the reserved part.

86. A telecommunication system in accordance with claim 67, wherein the size of the global address space is given by a control system in the controlling node.

87. A telecommunication system in accordance with claim 81, wherein the switches of the telecommunication system are of different kinds, thus providing a telecommunication system that comprises different kinds of switching technologies, where all switches are controlled by said controlling node.

88. A telecommunication system in accordance with claim 87, wherein the switches are selected from the group that consists of STM (synchronous transmission mode) based switches, ATM (asynchronous transmission mode) based switches or IP (Internet Protocol) based switches.

89. A telecommunication system in accordance with claim 88, wherein the switch in the controlling node is an STM-based switch and the additional switch in the external node is an ATM based switch.

90. A telecommunication system in accordance with claim 89, wherein the existing switch is a group switch.

91. A telecommunication system in accordance with claim 90, wherein a global address is a global multiple position, which is translated into a group switch multiple position for the existing switch, or into a virtual multiple position for an additional switch in an external node, said virtual multiple position representing the local address of the additional switch.

92. A telecommunication system in accordance with claim 80, wherein the global addresses and their respective translations are stored in a table.

93. A telecommunication system in accordance with claim 92, wherein said table is created in the connection handler when said allocation is performed and the information stored in the table is used by the connection handler when a connection is set up.

Summary of the invention

A telecommunication system comprising an cxisting node with at least an existing switch with physical inlets and a local address space for addressing said physical inlets. At least one additional switch is added to the system, one of said additional switches residing in node that is external to the existing node. The additional switch or switches in the external node have also physical inlets and a local address space or spaces for addressing its switch inlets. A global address space is created which comprises at least the local address spaces of the existing switch and said one additional switch in the external node. The existing has a connection handler for controlling the existing switch in the existing node and said one additional switch in the external node using the global address space.

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Date: 1999-12-09

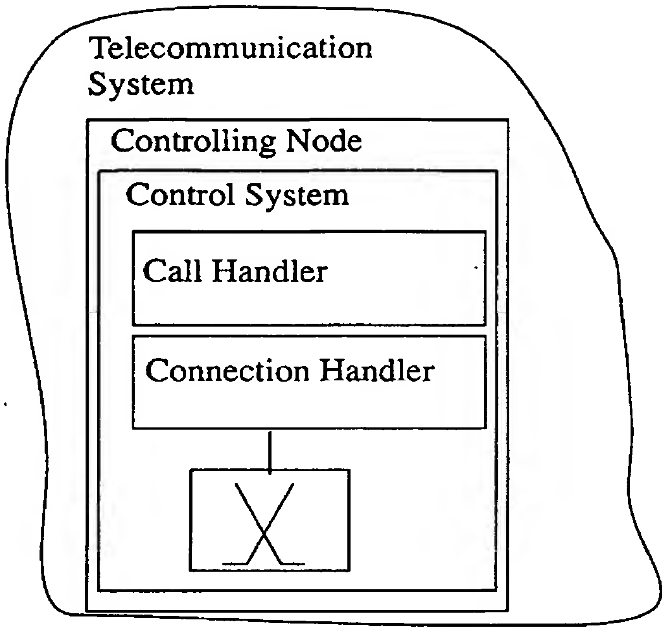

Fig 1a.

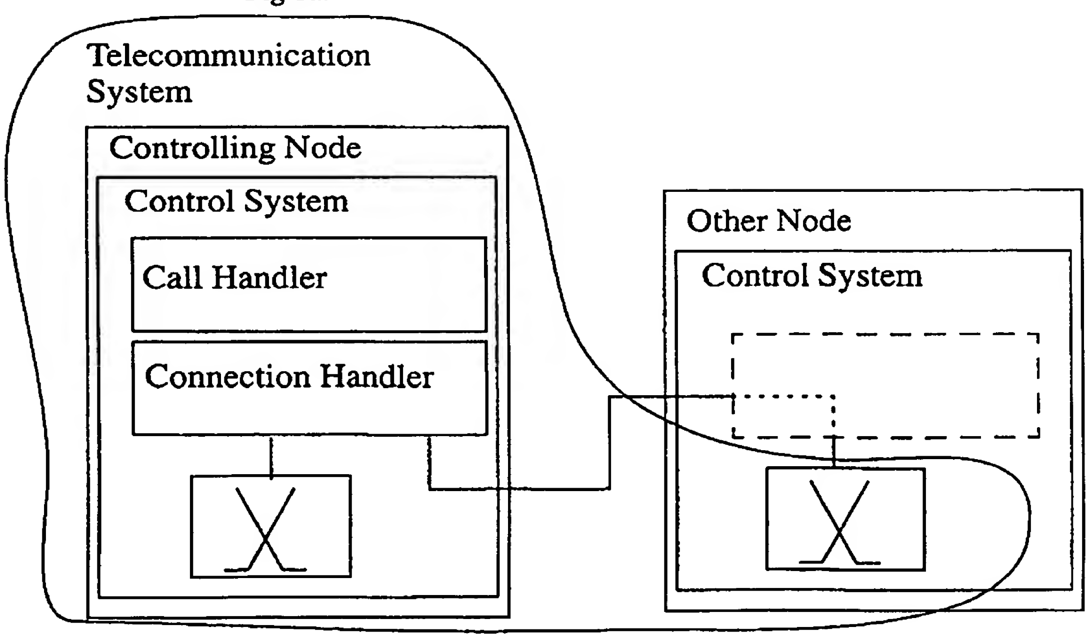

Fig 1b.

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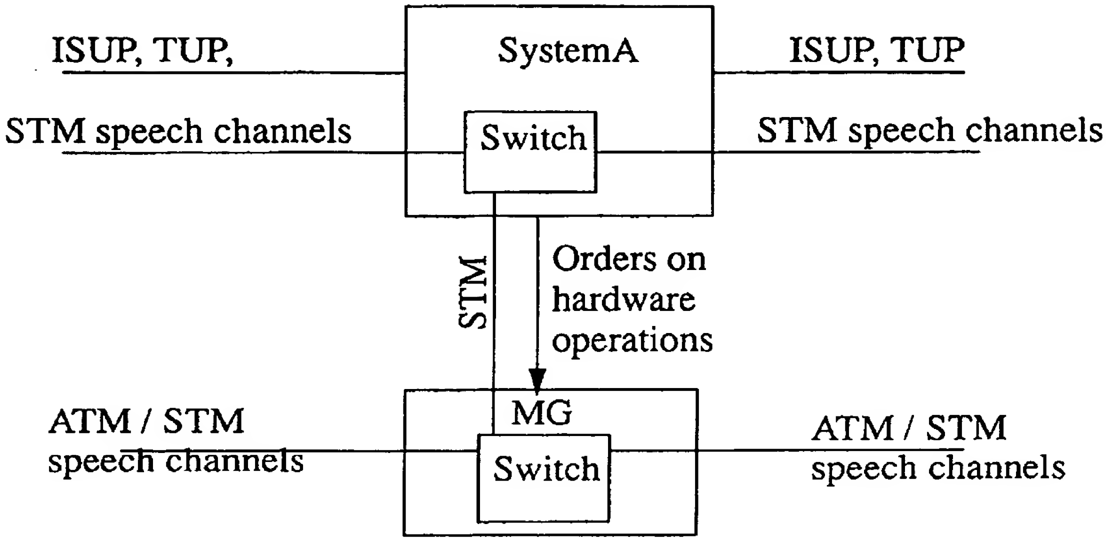

fig 2.

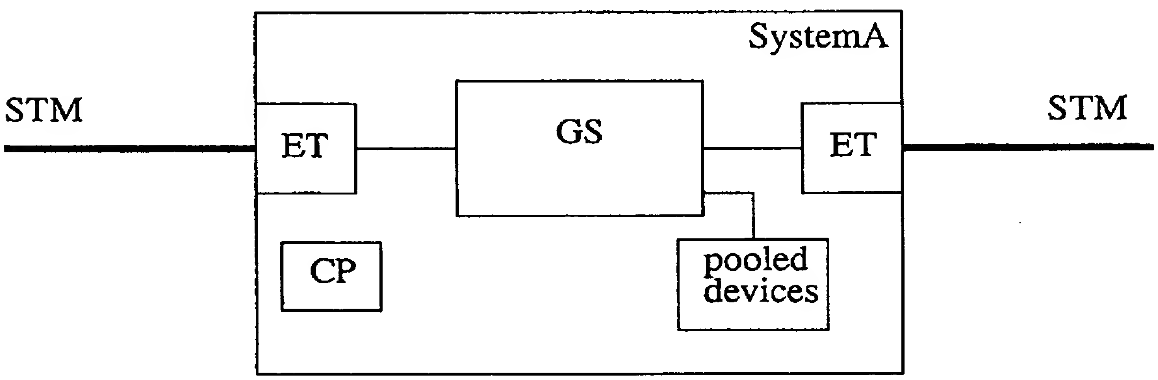

Fig 3.

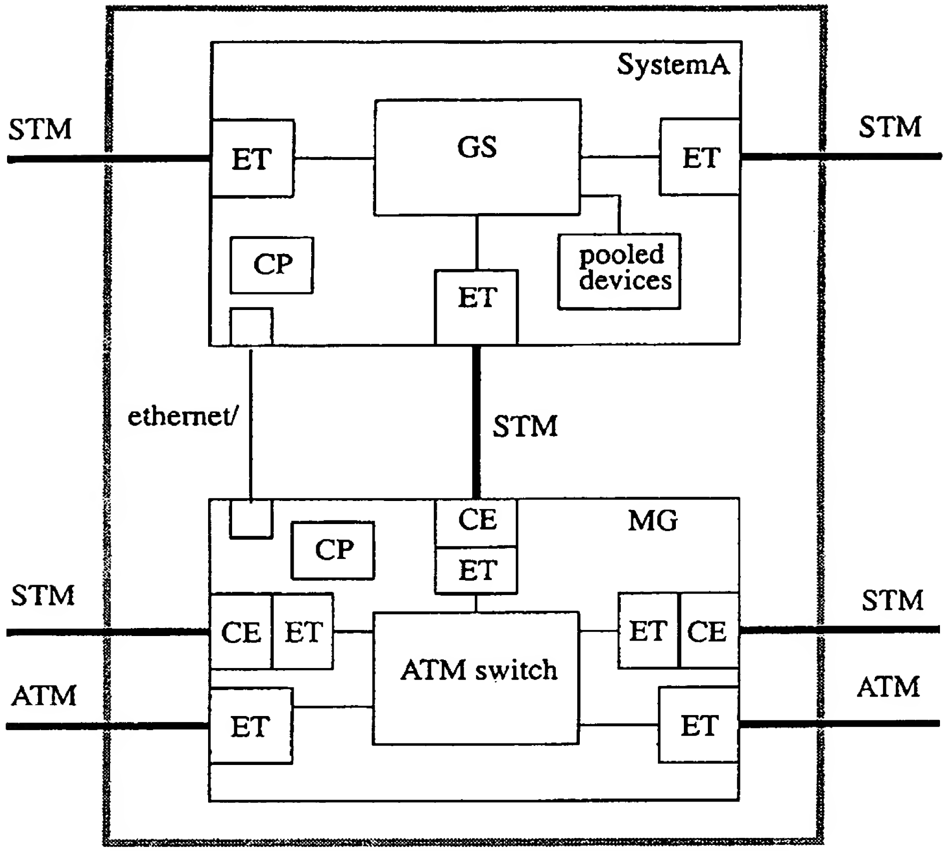
SystemA
STM
ET
GS
ET
STM
CP
pooled devices
ET
ethernet/
STM
CE
MG
CP
ET
STM
CE
ET
ET
CE
STM
ATM switch
ATM
ET
ET
ATM

Fig 4.

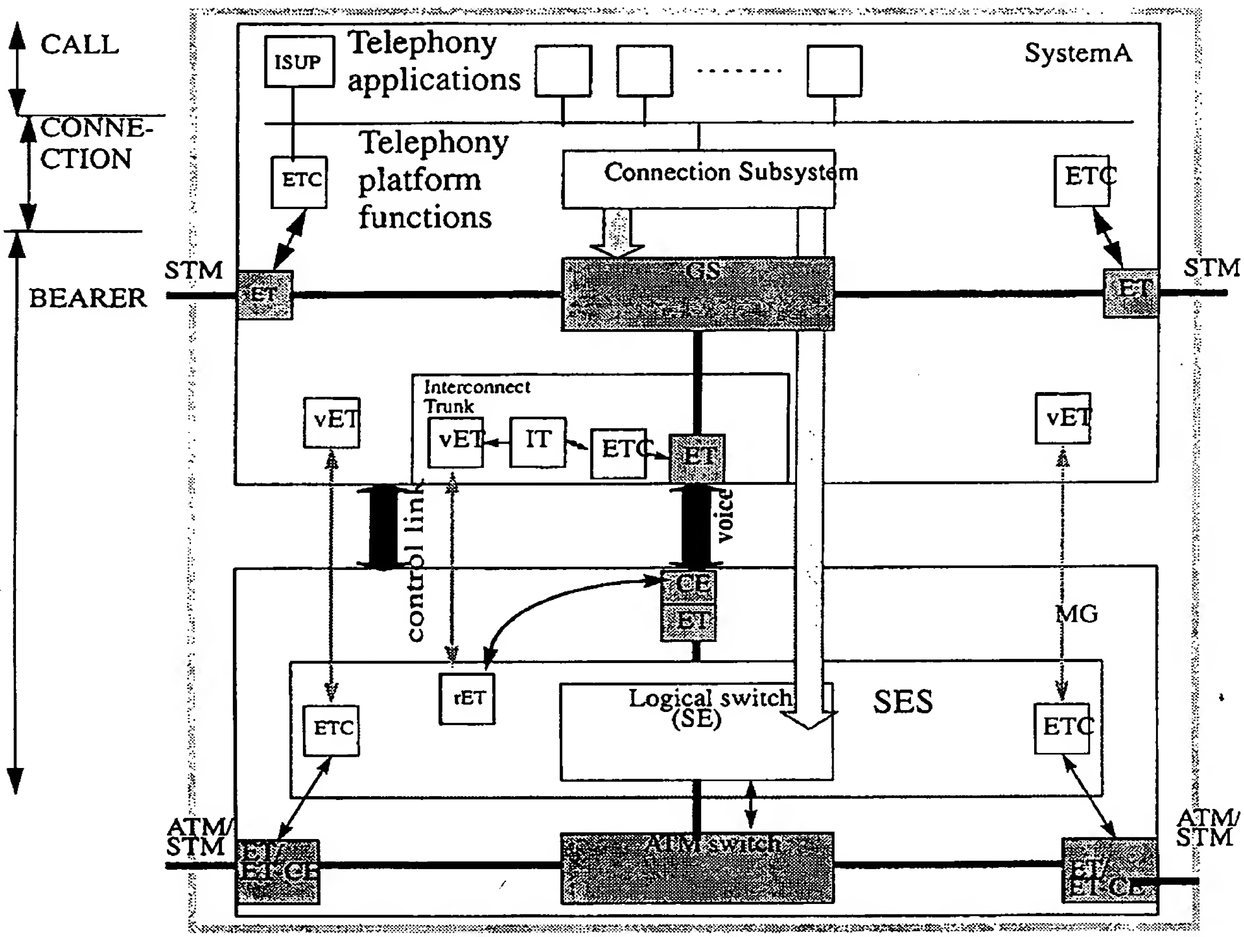
CALL
CONNE-
CTION
BEARER
SystemA
ISUP
Telephony
applications
Telephony
platform
functions
ETC
Connection Subsystem
ETC
STM
ET
GS
ET
STM
Interconnect
Trunk
vET
vET
IT
ETC
ET
vET
control link
voice
CE
ET
MG
rET
ETC
Logical switch
(SE)
SES
ETC
ATM/
STM
ET/
ET-CE
ATM switch
ET/
ET-CE
ATM/
STM

fig 5.

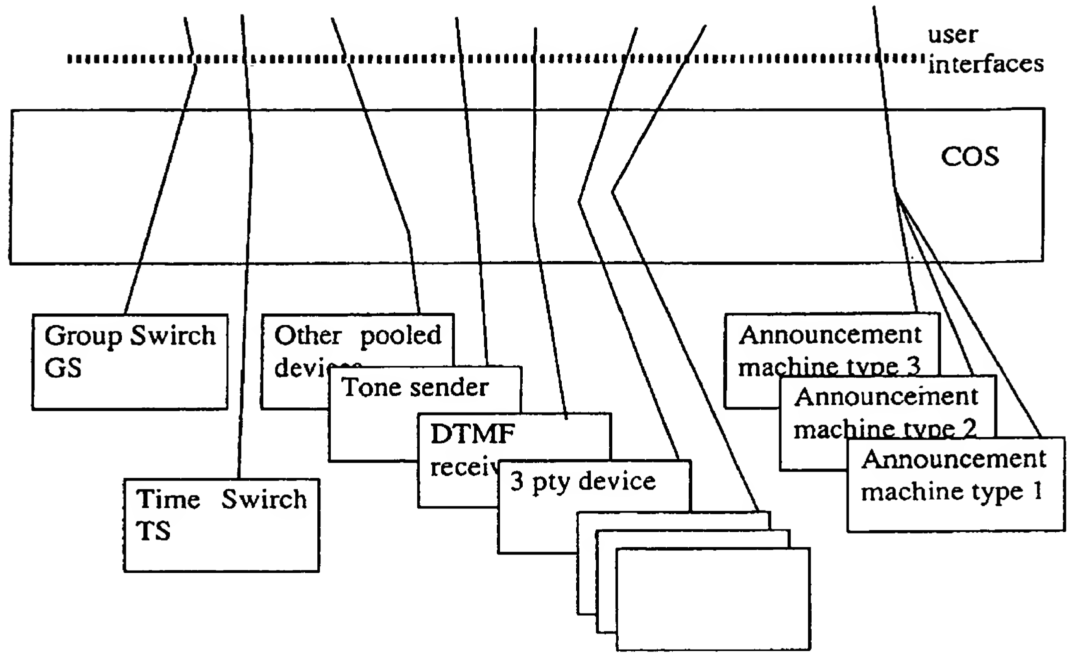
user interfaces
COS
Group Swirch GS
Time Swirch TS
Other pooled devi
Tone sender
DTMF recei
3 pty device
Announcement machine type 3
Announcement machine type 2
Announcement machine type 1

Fig 6.

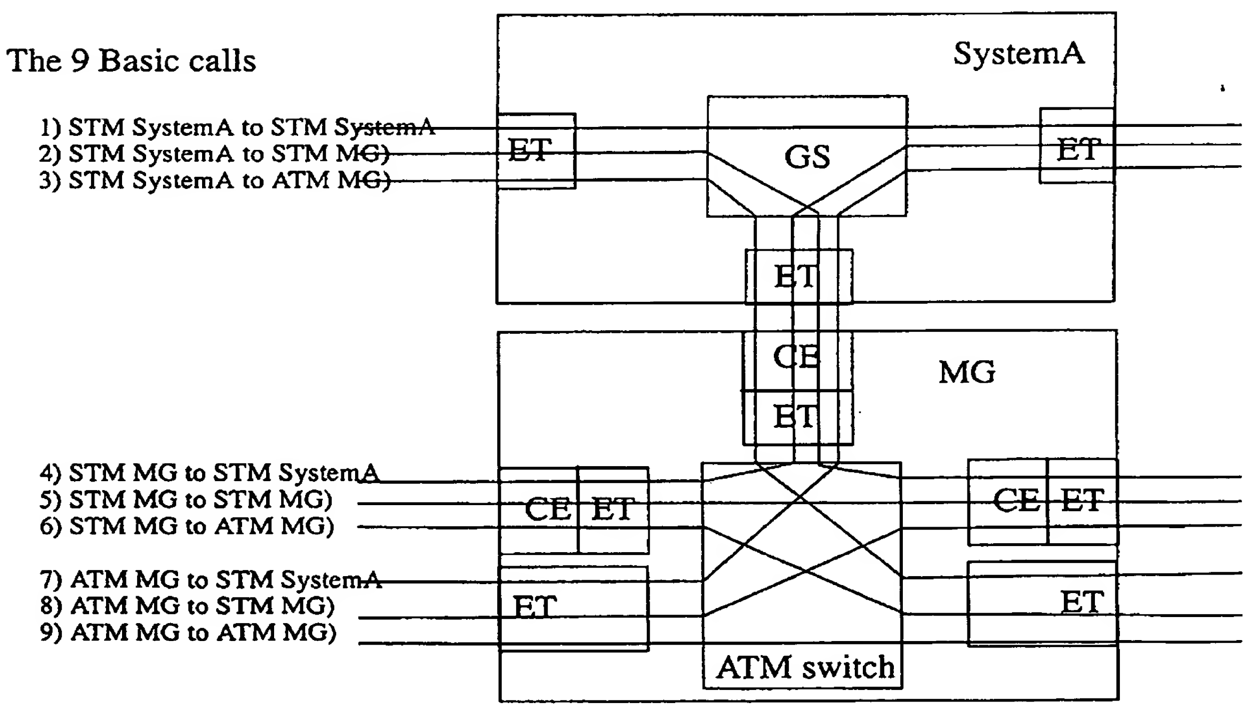
The 9 Basic calls
1) STM SystemA to STM SystemA
2) STM SystemA to STM MG)
3) STM SystemA to ATM MG)
4) STM MG to STM SystemA
5) STM MG to STM MG)
6) STM MG to ATM MG)
7) ATM MG to STM SystemA
8) ATM MG to STM MG)
9) ATM MG to ATM MG)
SystemA
ET
GS
ET
ET
CE
ET
MG
CE ET
CE ET
ET
ET
ATM switch

Fig 7.

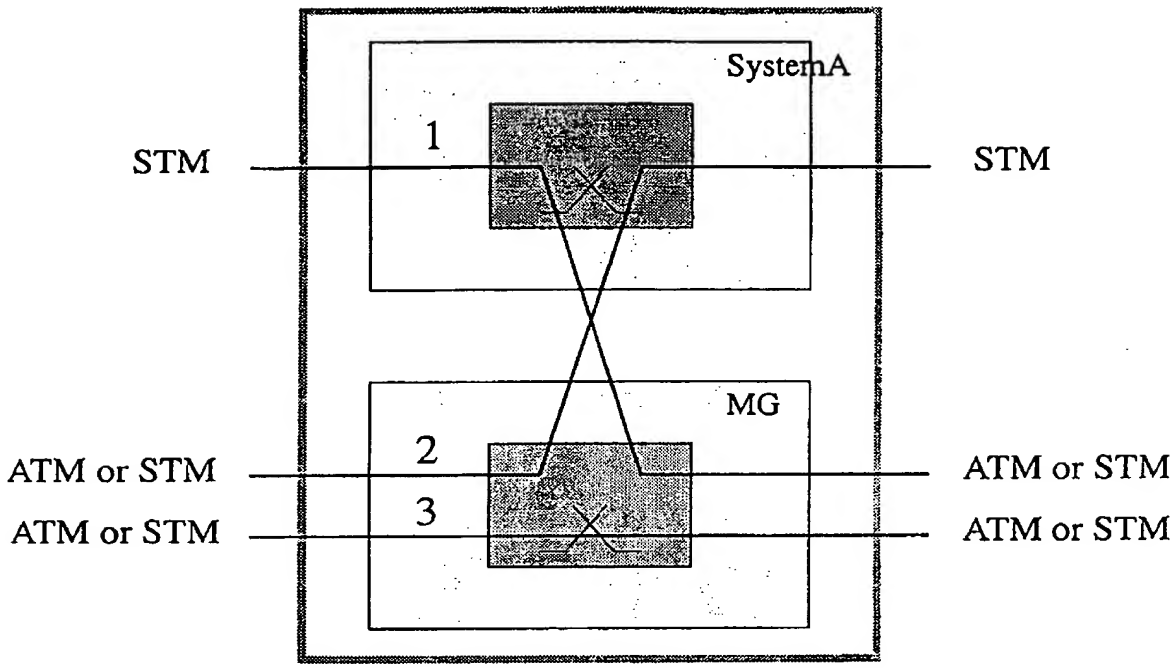
SystemA
1
STM
STM
MG
2
ATM or STM
ATM or STM
3
ATM or STM
ATM or STM

Fig 8.

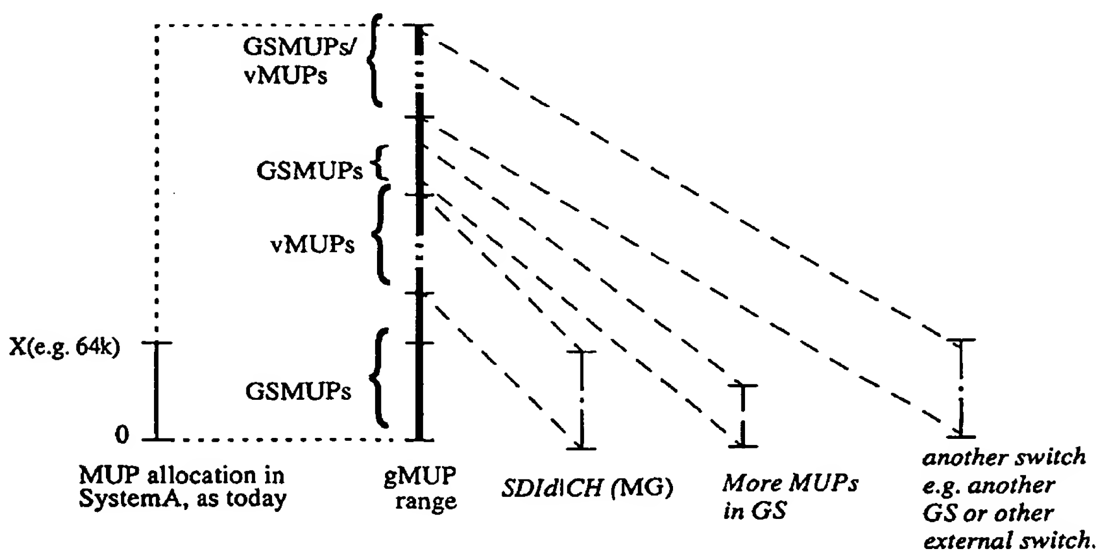
GSMUPs/
vMUPs
GSMUPs
vMUPs
X(e.g. 64k)
GSMUPs
0
MUP allocation in
SystemA, as today
gMUP
range
SDIdICH (MG)
More MUPs
in GS
another switch
e.g. another
GS or other
external switch.

Fig 9.

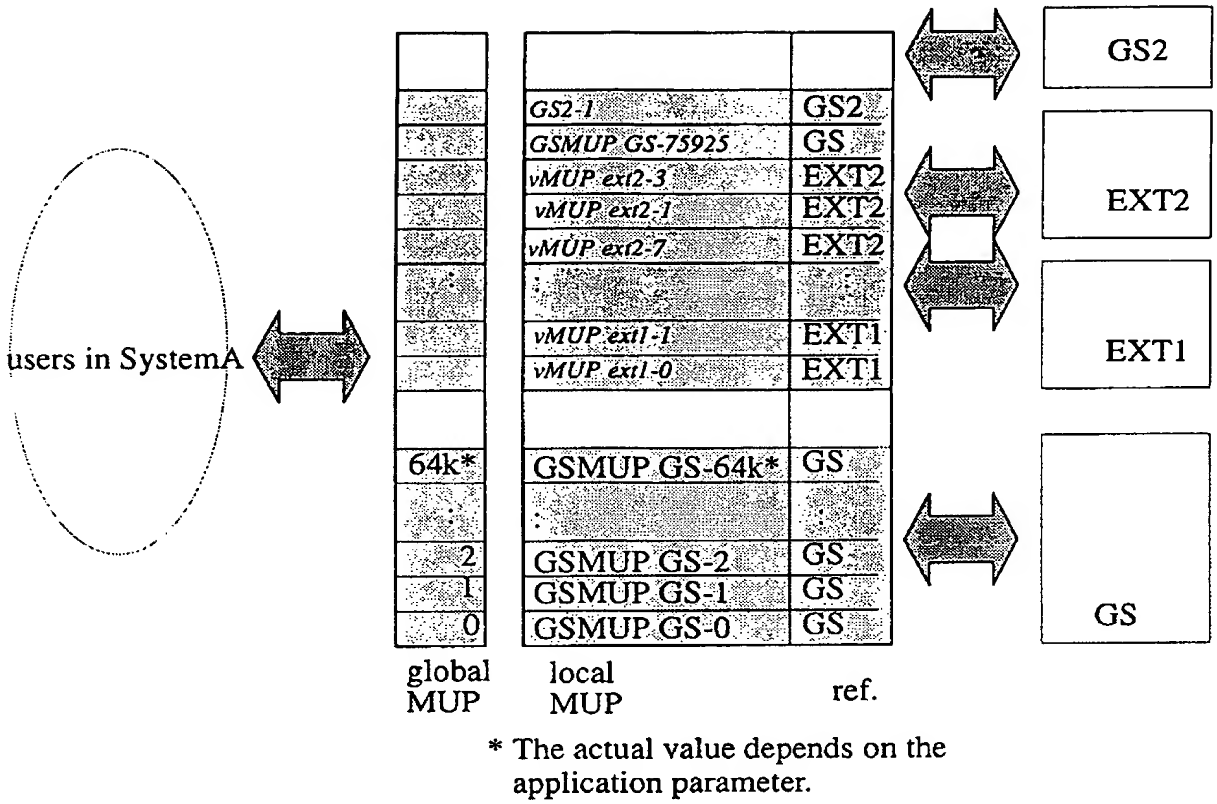
GS2
EXT2
EXT1
GS
users in SystemA
GS2-1
GSMUP GS-75925
vMUP ext2-3
vMUP ext2-1
vMUP ext2-7
vMUP ext1-1
vMUP ext1-0
64k*
GSMUP GS-64k*
2
1
0
GSMUP GS-2
GSMUP GS-1
GSMUP GS-0
GS2
GS
EXT2
EXT2
EXT2
EXT1
EXT1
GS
GS
GS
GS
global MUP
local MUP
ref.
* The actual value depends on the application parameter.

Fig 10.

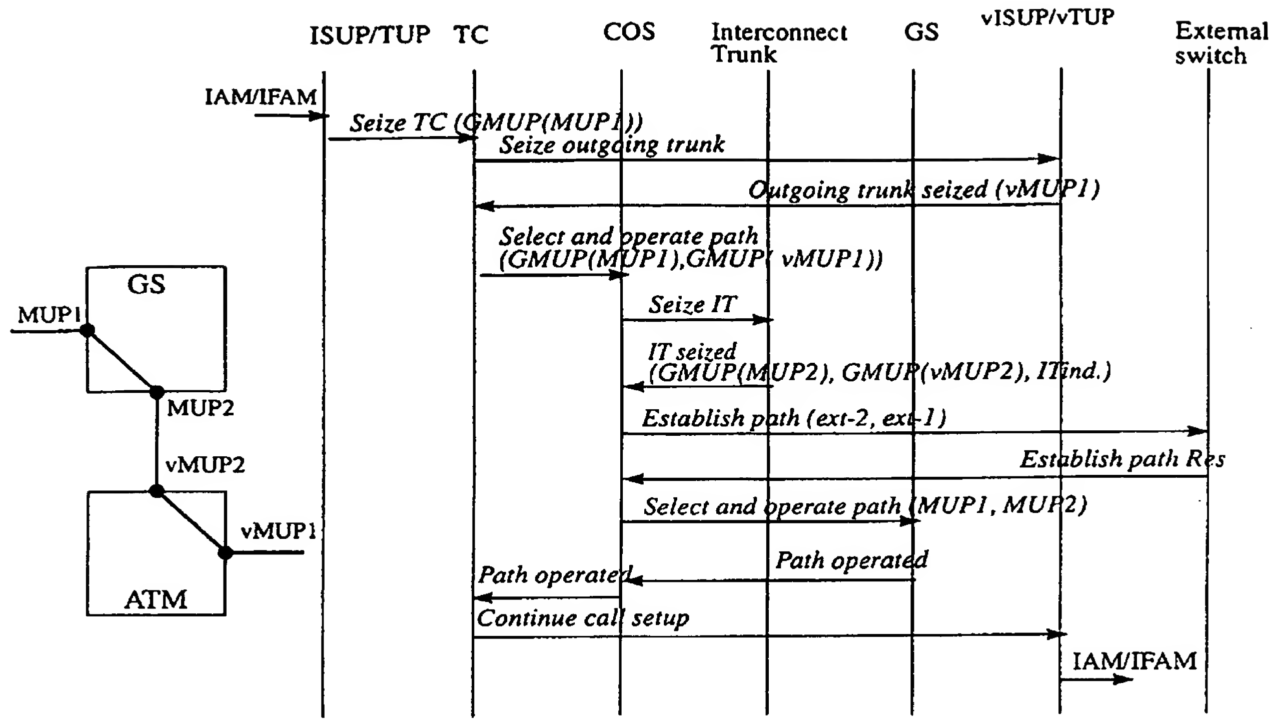
ISUP/TUP
TC
COS
Interconnect Trunk
GS
vISUP/vTUP
External switch
IAM/IFAM
Seize TC (GMUP(MUP1))
Seize outgoing trunk
Outgoing trunk seized (vMUP1)
Select and operate path (GMUP(MUP1),GMUP(vMUP1))
Seize IT
IT seized (GMUP(MUP2), GMUP(vMUP2), ITind.)
Establish path (ext-2, ext-1)
Establish path Res
Select and operate path (MUP1, MUP2)
Path operated
Path operated
Continue call setup
IAM/IFAM
GS
MUP1
MUP2
vMUP2
vMUP1
ATM

Fig 11.

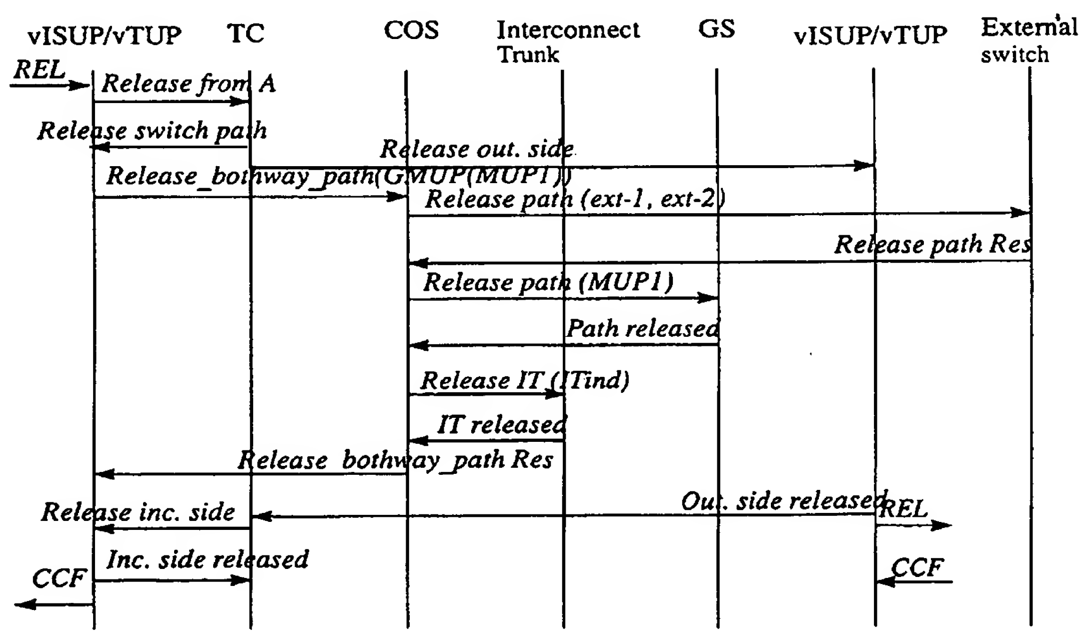
vISUP/vTUP
TC
COS
Interconnect Trunk
GS
vISUP/vTUP
External switch
REL
Release from A
Release switch path
Release out. side
Release_bothway_path(GMUP(MUP1))
Release path (ext-1, ext-2)
Release path Res
Release path (MUP1)
Path released
Release IT (ITind)
IT released
Release bothway_path Res
Out. side released
REL
Release inc. side
Inc. side released
CCF
CCF

Fig 12.

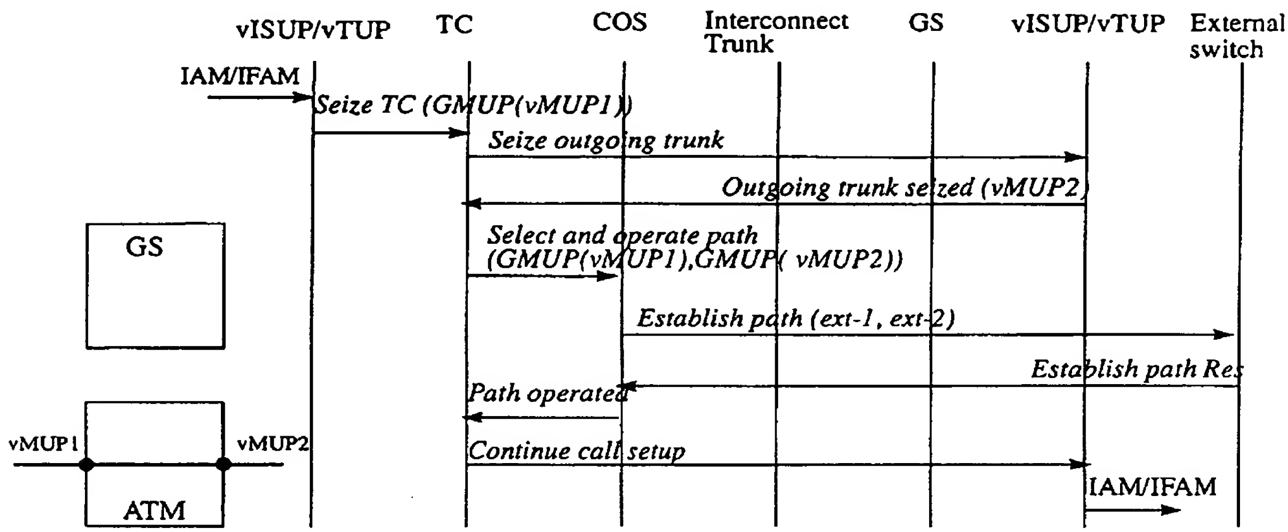
vISUP/vTUP
TC
COS
Interconnect Trunk
GS
vISUP/vTUP
External switch
IAM/IFAM
Seize TC (GMUP(vMUP1))
Seize outgoing trunk
Outgoing trunk seized (vMUP2)
Select and operate path (GMUP(vMUP1),GMUP(vMUP2))
Establish path (ext-1, ext-2)
Establish path Res
Path operated
Continue call setup
IAM/IFAM
GS
vMUP1
vMUP2
ATM

Fig 13.

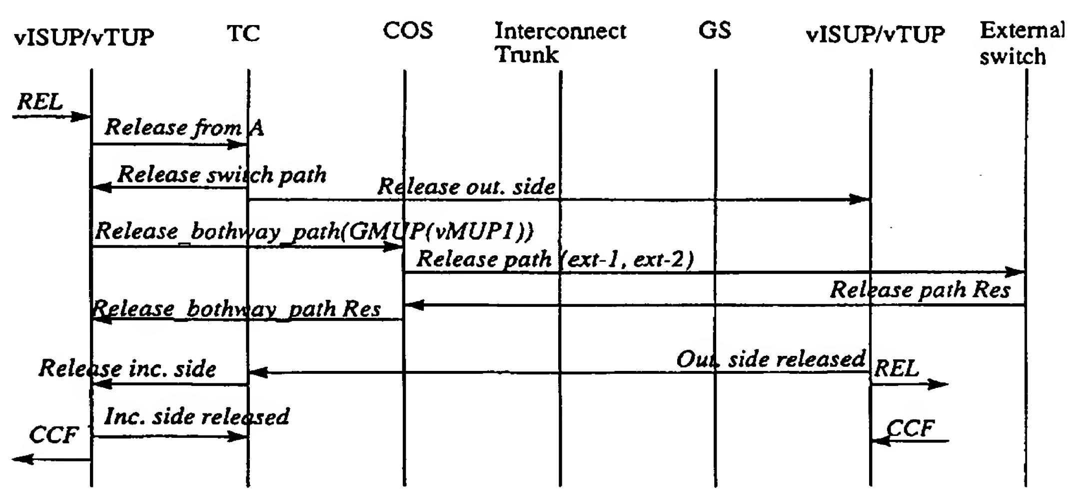
vISUP/vTUP
TC
COS
Interconnect Trunk
GS
vISUP/vTUP
External switch
REL
Release from A
Release switch path
Release out. side
Release_bothway_path(GMUP(vMUP1))
Release path (ext-1, ext-2)
Release path Res
Release_bothway_path Res
Release inc. side
Out side released
REL
Inc. side released
CCF
CCF

Fig 14.